MECHATRONICS BOOK SERIES

CONTROL AND INTELLIGENT SYSTEMS

Momoh Jimoh E. Salami
Abiodun Musa Aibinu
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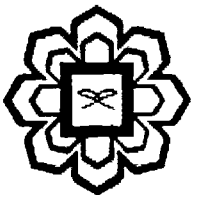

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Chapter 21
Visual-Based Intelligent Solar Tracking System

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21.1 Introduction

Many researches these days are conducted towards finding the best natural energy sources that can minimize the greenhouse gas emissions and global warming. One of these sources that is freely available at almost everywhere in the world is sun energy. Therefore, researches have been done worldwide in order to exploit this type of energy and to improve its efficiency.

One way to improve the efficiency of solar power plants is to use automatic solar tracking system whereby the system will continuously track the location of the sun such that the solar panels will automatically follow to maintain the optimum angle to take the most of the sun rays [1].

Intelligent systems are being developed and deployed worldwide in a wide variety of applications, mainly because of their symbolic reasoning, flexibility and explanation capabilities [2]. On the other hand, solar energy is rapidly advancing as an important renewable energy resource [3]. Renewable energy (RE) resources have an enormous potential to meet the present world energy demand. They can enhance diversity in energy supply markets, secure long-term sustainable energy supply, and reduce local and global atmospheric emissions. They can also provide commercially attractive options to meet specific needs for energy services, and offer possibilities for local manufacturing of equipment [4]. In remote areas the sun is a cheap source of electricity using solar cells to produce electricity. While the output of solar cells depends on the intensity of sunlight and the angle of incidence, to get maximum efficiency the solar panels must remain in front of sun during the whole day. But due to rotation of earth those panels can't maintain their position always in front of sun [5]. Intelligence techniques are becoming useful as alternative approaches to conventional techniques. They have been used to solve complicated practical problems in various areas and are becoming more popular nowadays. They can learn by trainings. The techniques are fault tolerant in the sense that they are able to handle noisy and incomplete data. Moreover, they are able to deal with nonlinear problems and once trained, the techniques can perform prediction and generalization at high speed [6]. Therefore, intelligent solar tracking systems have received a lot of attention in recent times. They are mainly used to improve efficiency for solar cell, sun finder and solar tracking system.

In this paper, we present an intelligent system for tracking sun location based on computer image processing and sound cards. This is done by using web camera as a vision sensor and sound card as an output channel to drive a motor. In other words, the motors will react as the mechanism of the camera to make sure that the solar panels will always optimally focus on the target, i.e. the sun light. The intelligent algorithm MATLAB software programming environment is implemented to provide interaction between camera and sound card as a device to control the motor to track the light. Moreover the system can manage the errors by send the Pulse Width Modulation (PWM) for the speed control since the Data Acquisition Toolbox can support the PWM in the m-file coding. The work is an extension of the work in [14] and [15].